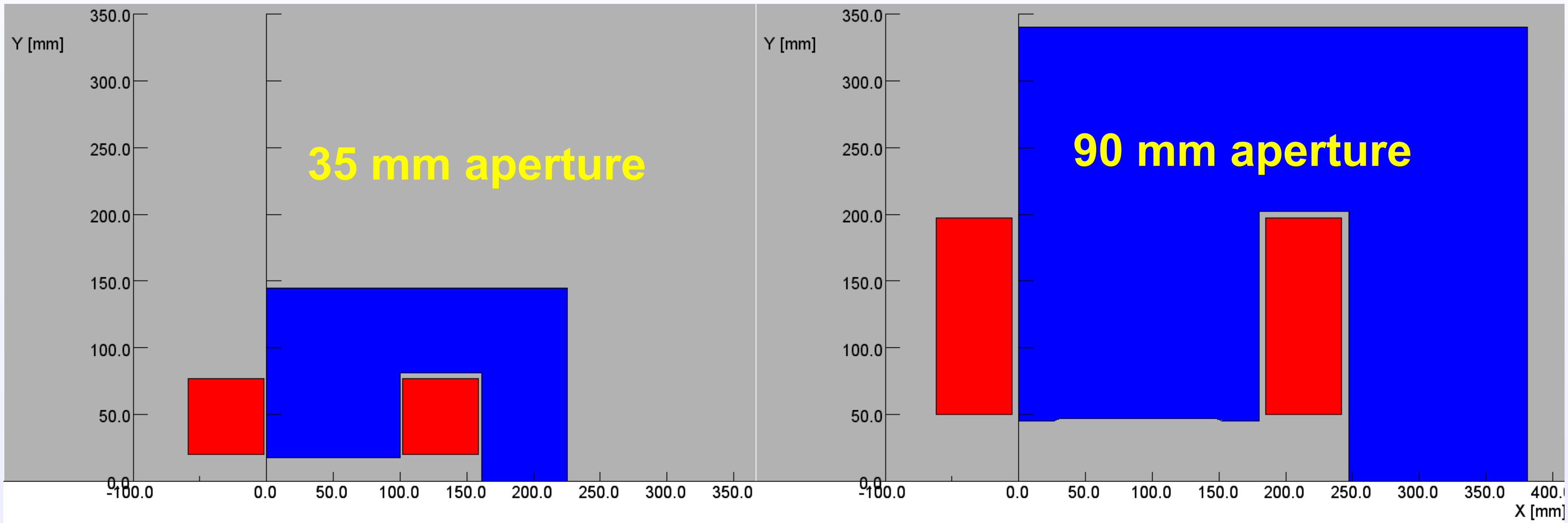
Preliminary 2-d and 3-d Designs of 90 mm Dipole

Ramesh Gupta

Comparison of 35 mm and 90 mm Aperture Dipoles

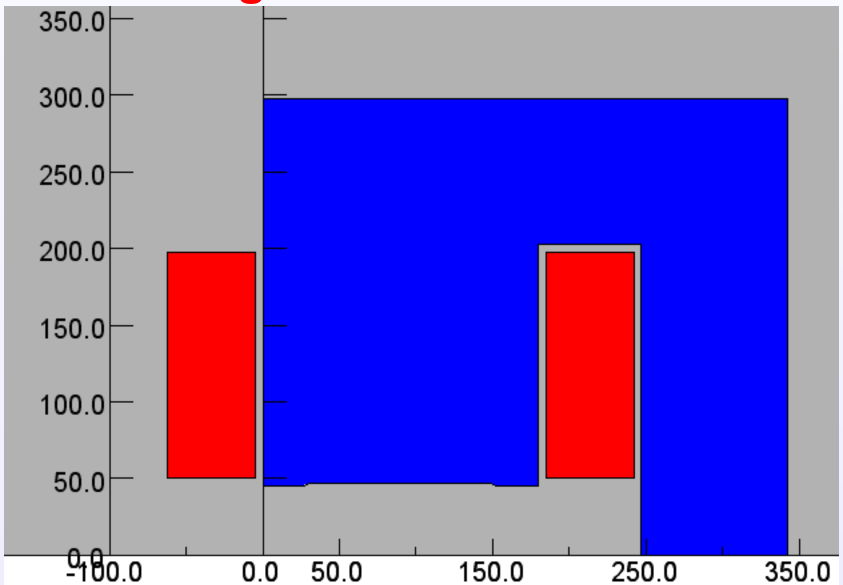


- Same conductor is chosen as in 35 mm dipole. The number of turns are adjusted.
- No. of turns: 16 (4 X 4) in 35 mm aperture and 40 (4 X 10) in 90 mm aperture.
- Make transfer function of this dipole of two dipoles similar (???) with a maximum ~1% deviation (???).

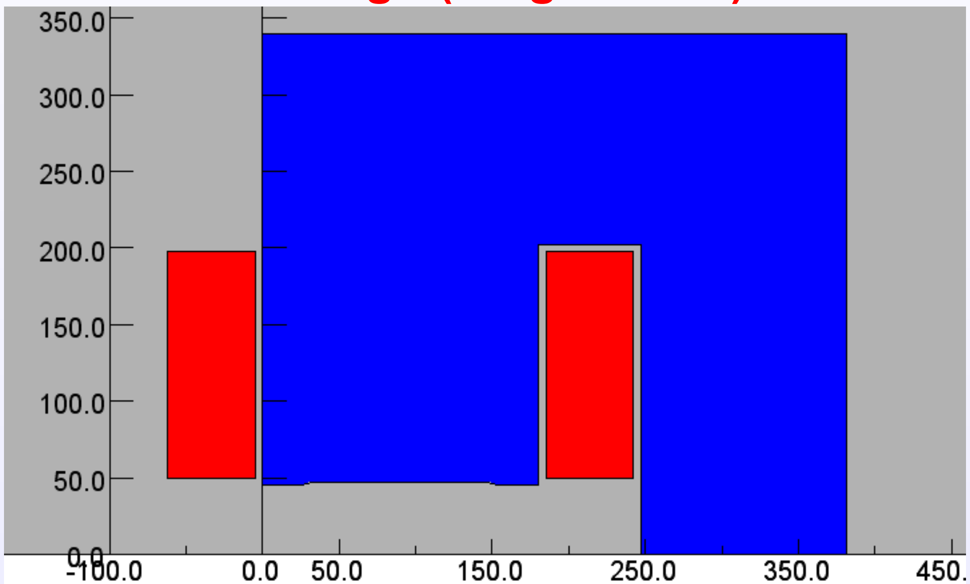
Note: 90 mm is a nominal aperture if the two magnet runs on same power supply. Adjust aperture to match transfer function better in the same power supply case.

Preliminary 2-d Design of ~90 mm Dipole

Design Presented Last Week



New Design (Larger Yoke)



- Yoke size increased due to mechanical concern.
- More increase (cost) should wait for mechanical analysis.

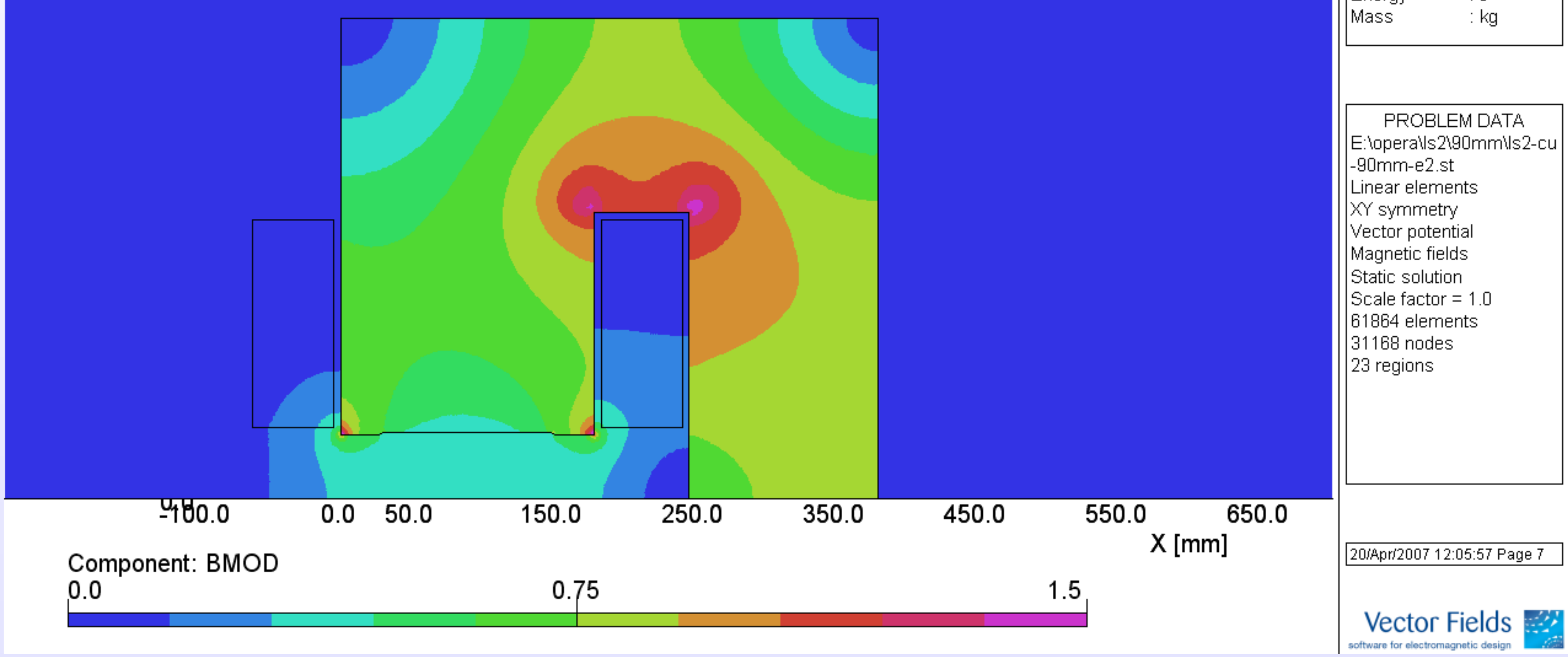
Both designs meet the following stated requirements:

- Nominal Field – Bo = 0.40T to 0.50T
- Field Homogeneity BX,BY=1x10-4
- Good field region BX +/- 20mm, BY +/- 10mm
- Nominal Current density in the coil cross section 2 Amps/mm^2

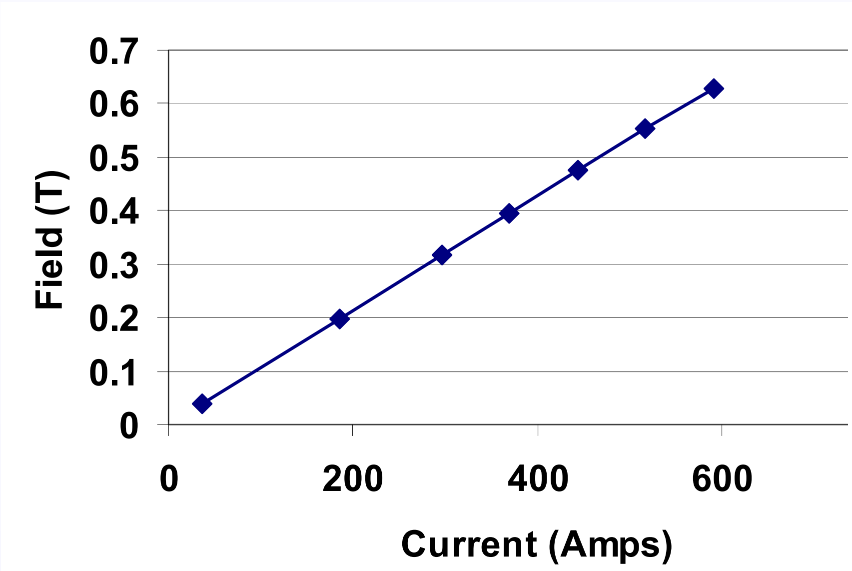
Yoke Design

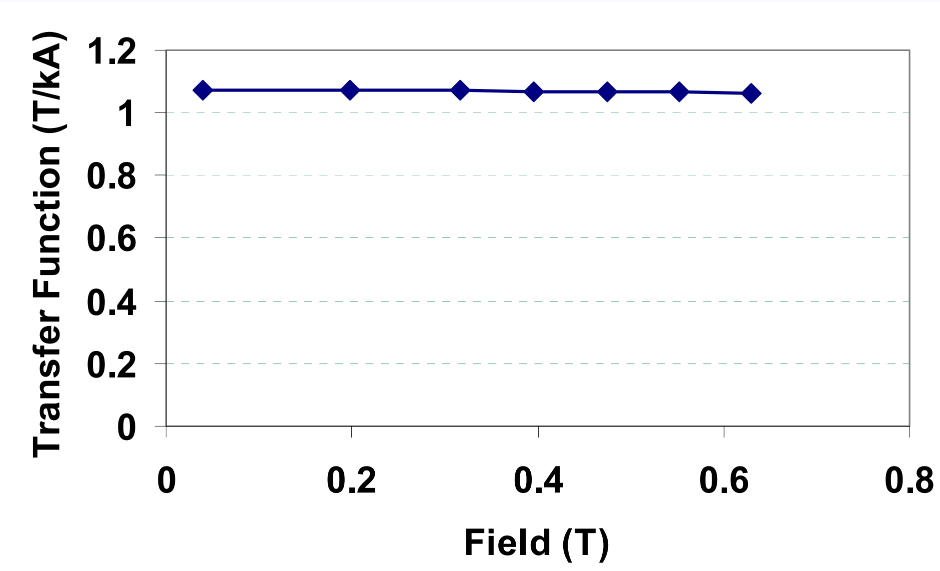
The maximum field in the yoke is 0.8 T for 0.4 T central field.

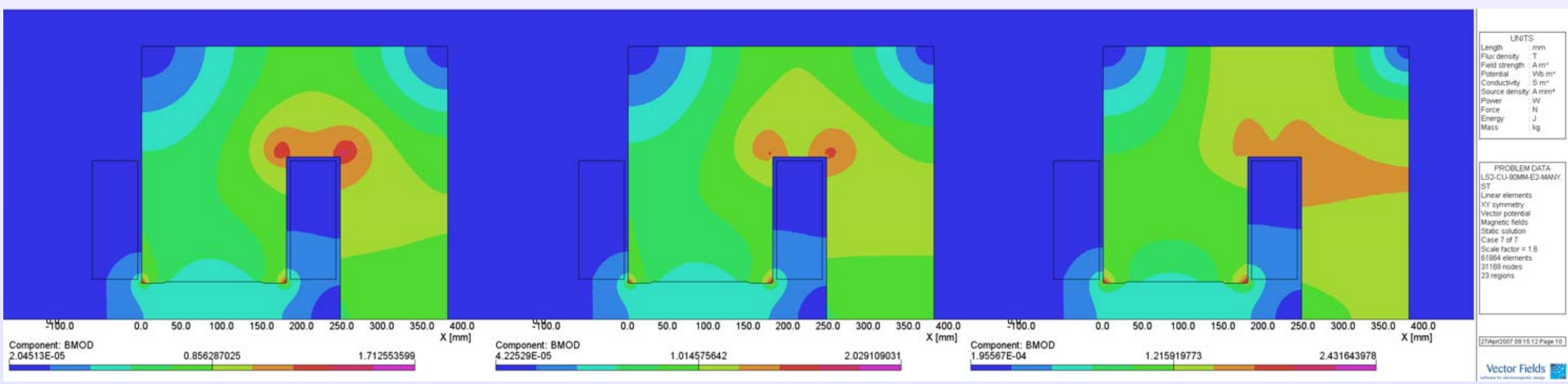
Therefore, the need for an increase in yoke size must be justified on mechanical ground.



Iron Saturation in 90 mm Aperture Dipole

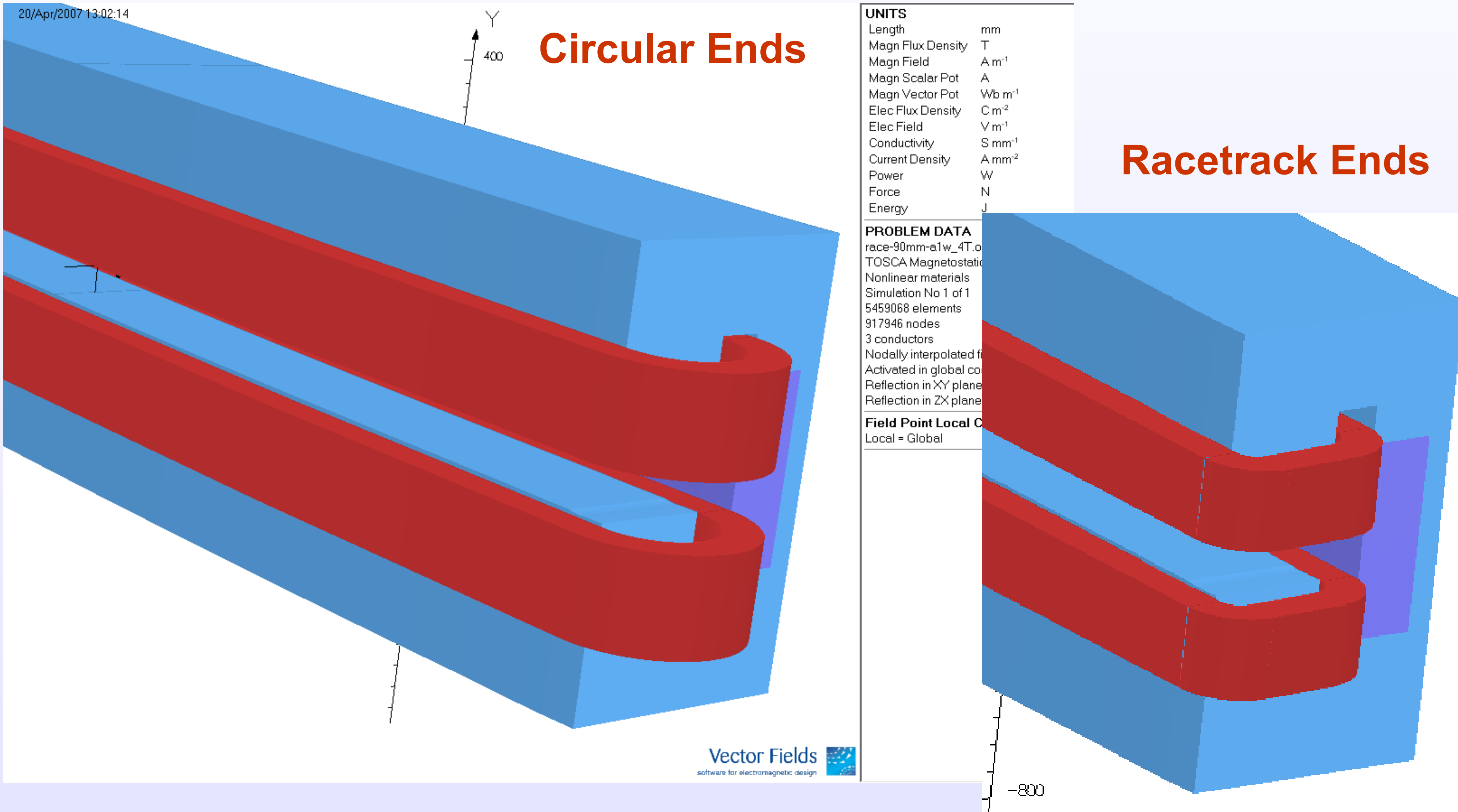




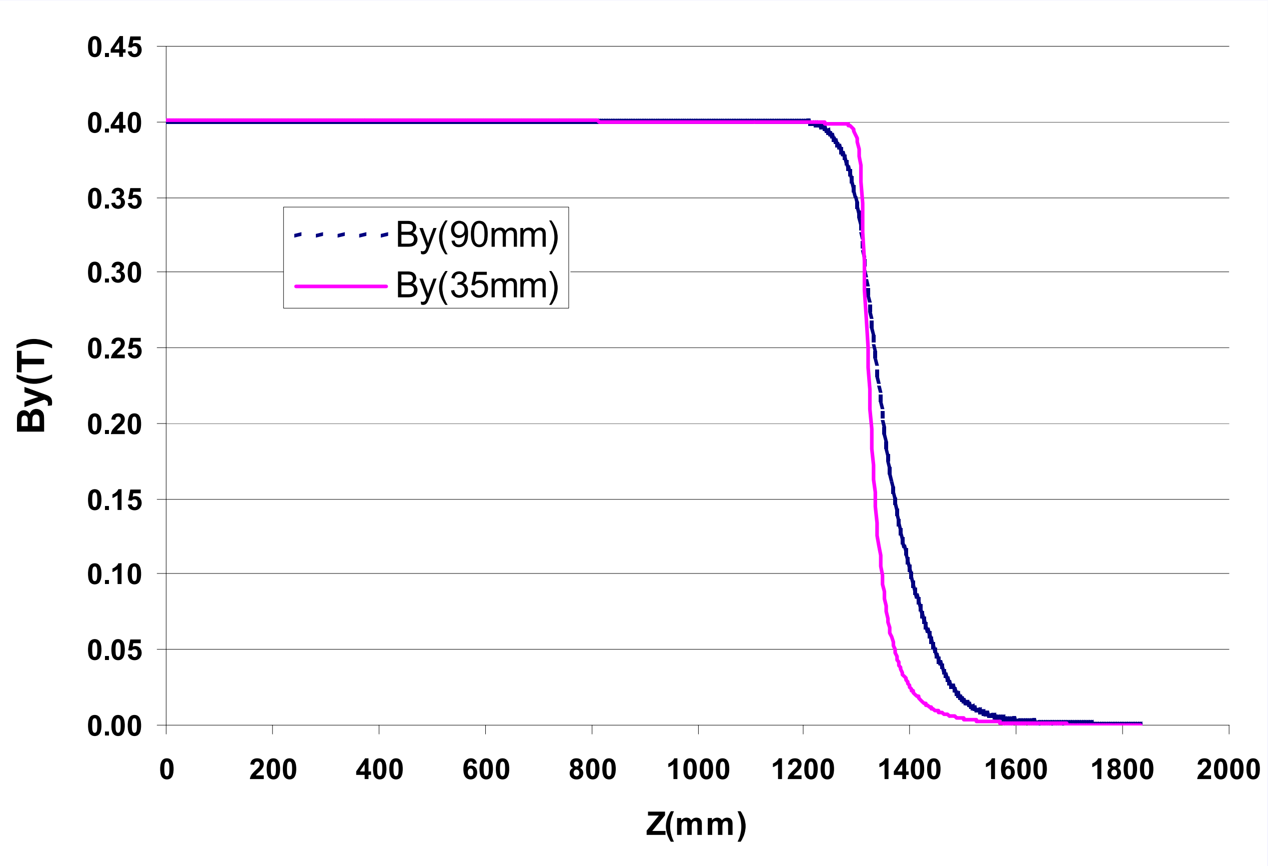


Design field | **20% over the design field** | **60% over the design field**

Preliminary 3-d Analysis of ~90 mm Aperture Dipole



Comparison of Axial Field Profile of 90 mm and 35 mm Aperture Dipoles

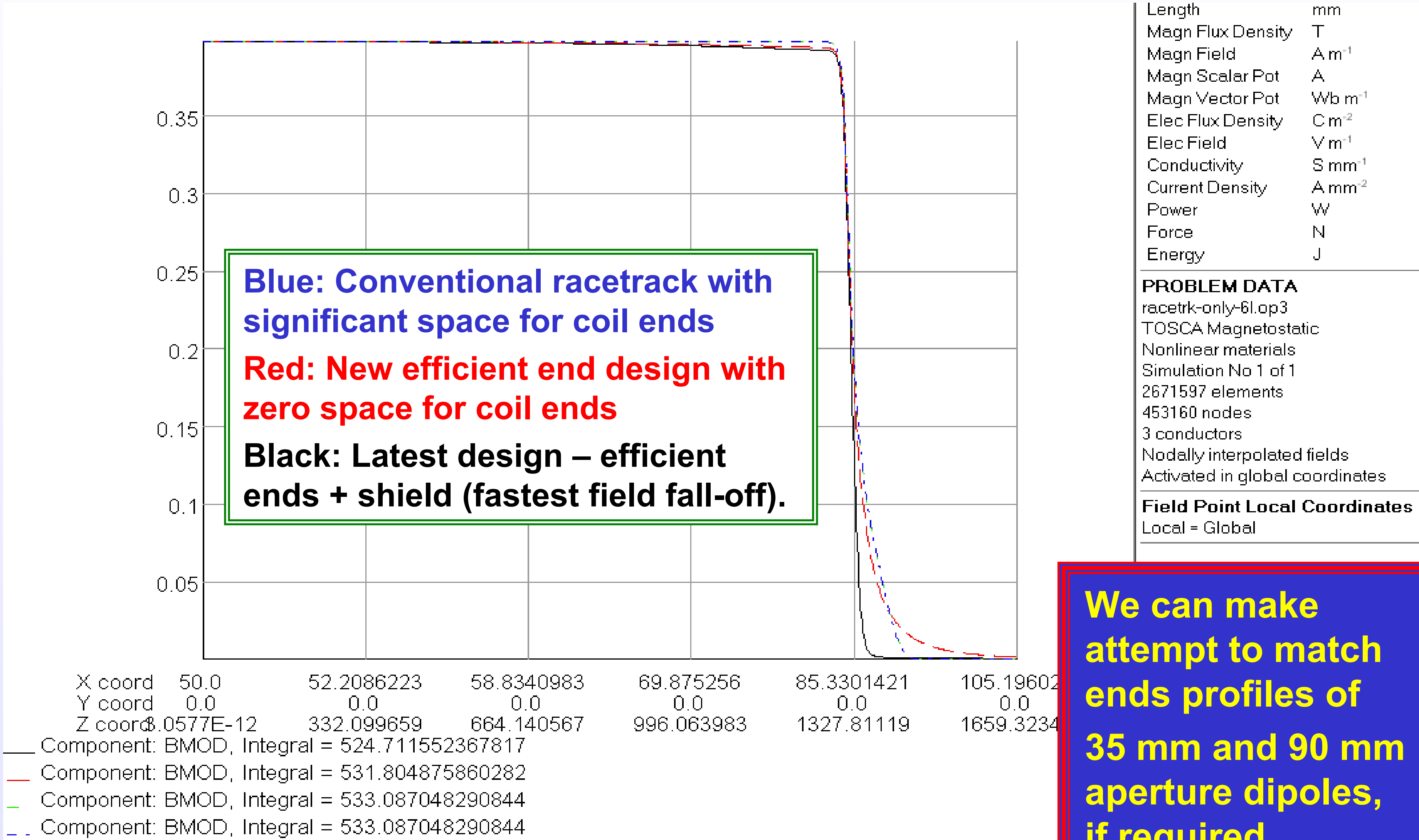


The goal is to match the integral transfer function of the 90 mm aperture dipole with that of 35 mm aperture dipole for the same current (number of turns are different in two).

Also compare the end field profile of the two magnets.

As expected, the field of 35 mm aperture dipole falls slower than the field of 90 mm aperture dipole. End harmonics in both apertures will be optimized.

Review of End Fields in Various Designs



Blue: Conventional racetrack with significant space for coil ends

Red: New efficient end design with zero space for coil ends

Black: Latest design – efficient ends + shield (fastest field fall-off).

We can make attempt to match ends profiles of 35 mm and 90 mm aperture dipoles, if required.